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Assessing the Integration of Embedded Metacognitive Strategies in College Subjects for Improved Learning Outcomes: A New Model of Learning Activity

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Abstract

The most effective pedagogies are those that foster students' metacognition and their learning effectiveness. This paper presents a new model of activity-based learning in which students construct knowledge using practices that include constructs of engagement, motivation, and affect that drive deeper processing and higher levels of metacognitive development. The model is built upon metacognitive constructs that promote deeper learning and develop important cognitive skills regardless of cognate content or academic discipline. Based on research in two different disciplines, results indicate that students were successful in demonstrating an understanding of complex constructs when instructed using this novel model and reported increased learner satisfaction and effectiveness.

Keywords: Metacognition, activity-based learning, learning strategies, learning effectiveness.

Since McKeachie (1974) discussion continues on the relationships between specific teaching strategies, learners, and the learning experience. Various modalities of instruction, such as lectures, in-class exercises, and collaborative assignments, as well as various combinations of instruction types have been the topic of significant research over the last thirty years. However, questions remain about which teaching strategies have the greatest perceived value to learners and measured learning effectiveness. In order to continue the research and present additional answers to these questions, the research in this paper focused on the development of a new model of instruction derived from metacognitive constructs and activity-based learning. The purpose of the model was to present an approach to instruction that can be utilized by professors across academic domains for developing a deeper student understanding of instructional content and promoting student satisfaction and content mastery.

Since the mid 1990s, constructivist based views that recognize learners as active participants in their learning experience have largely supplanted traditional passive, behavioral approaches to teaching and learning (Bransford, Brown, & Cocking, 1999; Salas & Cannon-Bowers, 2001, Mayer, 2004). Constructivist theories assert that the best learning

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happens when students are active agents processing content, assuming responsibility for, and exerting control over their own learning processes (Winne & Hadwin, 1998). Research has demonstrated that active learning of this sort promotes the development of self-regulation and self-facilitation skills (Ivancic & Hesketh, 2000), which are the main components of metacognition (Flavell, 1979; Brown, 1987). Meece, Blumenfeld, and Hoyle (1988) have shown that the development of such metacognitive ability correlates to academic achievement and student learning success. Stewart, Cooper, and Moulding (2007) have confirmed this, demonstrating that students with more developed metacognitive skills achieve greater academic success. Other researchers have shown that learners' knowledge about their own thinking and metacognition impacts not only learning outcomes, but also tends to increase the level of effort they devote toward their learning (Flavell 1992; Hartman, 2001; Brown & Ford, 2002).

Additional contributors to the study of metacognition include Cannon-Bowers, Rhodenizer, Salas, and Bowers (1998), who noted that "metacognition emphasizes self-monitoring of one's cognitive functions, which assists learners in becoming active in their education instead of being passive recipients of instruction" (p. 296). Since the primary components of metacognition include self-regulation, planning, and monitoring, other researchers have argued that the ideal learning environment should facilitate self-directed and active learning (Holyoak, 1991; Sweller, Mawer, & Ward, 1983). This type of learning is an inductive process, in which learning is developed through exploration and experimentation (Ford & Kraiger, 1995), in contrast to a more deductive method where learner exploration is constrained by a passive pedagogy (Keith & Frese, 2005). Further, active learning requires skills of adaptive transfer in which learners can create new scenarios and solutions to demonstrate their growing understanding (Ivancic & Hesketh, 2000). The researchers suggest that the effectiveness of active learning, adaptive transfer, metacognitive embedded constructs, and exploration can be further evaluated using a novel model referred to as the: construction-deconstruction-connectionist process (CDC Model) using collaborative in-class activities. The CDC model is built upon the premise that learning in the classroom is not only a cognitive event; it is also a psychodynamic, social process (Illeris, 2004). In such, the CDC model considers classroom instruction as involving four metacognitive domains: the domains of self, professor, classmates, and learning environment (Pang, 2008). Research conducted by Pang suggests that a pedagogy founded upon active learning instructional strategies facilitates the development of metacognitive ability, improves learner performance, and enhances the learner's overall learning experience. To test the model this paper presents research findings from the use of the CDC model by two different professors in two distinct content areas: criminal justice and English literature; that are typically sites for more traditional, passive learning.

An Overview of an Active, Constructivist Pedagogy

According to Huitt (2003), the foundation of the constructivist approach is that "an individual learner must actively build knowledge and skills (e.g., Bruner, 1990) and that information exists within these built constructs rather than in the external environment" (p. 386). In active learning the student assumes responsibility for the learning experience.

The student has control and makes choices as to engagement and outcome; it is a student-centered environment. Bonwell and Elison (1991) defined active learning as "anything that involves students in doing things and thinking about the things they are doing" (p. 2). Active learning requires the metacognitive components of self-regulation, monitoring, and reflection. In contrast, traditional passive learning environments, such as lectures ask students only to listen and, perhaps, to take notes, assuming they can fully absorb and understand new information without active inquiry or any other kind of active management of or response to the data to be learned. Researchers have found that this type of information-dissemination instruction, when compared to more robust methods of instruction, has fallen significantly short in developing students' cognitive abilities and academic skills (Dean, 2006; Douglas, Burton & Reese-Durham, 2008). Active pedagogies, on the other hand, by placing an emphasis on induction, experimentation (Smith & Waller, 1997), and knowledge construction (Wells, 1985) have proven to produce longer lasting recall and more productive thinking and study skills.

Contemporary constructivist views of learning also suggest that knowledge construction is based on experiences and beliefs, a derived epistemology that scaffolds on the continual interaction between the learner and the experience (Bransford, Brown, & Cocking, 2000). In this context active learning requires not only metacognitive development but an understanding of one's self in the learning process, and, indeed, the present research with criminal justice and literature students supports these theories. By designing learning based on an active, constructivist approach, professors can elevate their students' levels of understanding, generate learning self-confidence and motivation (Pang, 2008), and promote deeper, longer lasting learning. Research on active, constructivist learning models is persuasive. For example, in a study emphasizing problem-based learning, Reeves and Francis (2002) found that pharmacy students were more inquisitive in the learning process and retained content better when instruction strategies required them to apply new information to real life scenarios they might encounter in the working world. Vaughn, Gonzalez del Rey, and Baker (2001) developed a novel instructional method they named "microburst learning" that combined role-plays, experiential activities, group discussions, and simulations that are presented as "short bursts. Their outcomes indicated more effective learning, including increased attention and motivation. In preliminary research on the development of metacognitive expertise based on the active-learning CDC model Pang found that developing a personal epistemology was one of ten components of metacognitive expertise that predicted academic success. Similarly, when using a form of the CDC model that preceded reading assignments with questions and discussion about students' personal experience with the types of characters or human issues represented in the assigned texts, the researchers found students consistently reported greater understanding, better recall, and, indeed, pleasure in their learning experience.

Personal epistemology research has examined learners' beliefs about the nature of knowing and knowledge (Hofer, 2004; Schraw & Sinatra, 2004) and has demonstrated that learners with more complex and refined beliefs perform better in academic achievement (Schommer, 1994) and conceptual change learning (Mason, 2003). Responses to this data include Giesbrecht's (1996) advocacy of "instructional strategies that provide an epistemological pluralism and accept the validity of multiple ways of knowing and thinking"

(p. 2). A learner's personal epistemology provides insights on his or her views about the nature of his or her knowledge and allows learners to make personal connections. These epistemological beliefs are not only related to ways of learning but also to how learners approach processing learning tasks (Hofer & Pintrich, 1997). In additional research, Hofer (2004) and Tsai (2004) asserted that a learner's epistemology guides cognitive and metacognitive activities in various learning environments. Research into student beliefs has revealed that certain students view learning as understanding via knowledge construction, representing a constructivist perspective, whereas other students view learning as memorization and recollection or knowledge reproduction, representing a more passivist learner orientation (Bereiter & Scardamalia, 1989; Chan & Sachs, 2001). Students who view learning as a knowledge reproduction task tend not to personalize or internalize the learning experience, while students who are constructivist and oriented towards knowledge construction tend to be "inherently progressive" (Bereiter & Scardamalia, 1993, p. 165), engaged internally, and active in searching for deeper understanding.

The researchers propose that an active, constructivist-oriented instructional strategy that engages metacognitive skills and that promotes motivation and personal epistemology proves to be more meaningful in student development. Studies continue to reveal that the higher level thinking of learners with well-developed personal epistemologies are more sophisticated (Fink, 2003) and their decision-making skills are more durable (Tu, Shih, & Tsai, 2007). Hence, combining an active, constructivist instructional strategy with ones that engage metacognitive skills and that promote motivation and personal meaning-making appears to be an ideal model for learner development.

Transforming existing pedagogies to foster active learning may promote more effective and meaningful learning. However, accomplishing such large-scale change is and will be difficult and will meet with significant resistance. Professors who are used to and feel successful using more traditional passive instruction methods must be convinced to adjust not only their classroom practices, but also the pedagogical paradigm upon which much of their professional life has been based. This research is a step towards suggesting to traditional passive instructors the benefits of adapting, however incrementally; to teaching that uses more active learning methods. The CDC model uses learning activities that build students' metacognitive skills, shore up their ability, encourage their willingness to question and explore, and demonstrates more clearly the usefulness and value of their learning to them. To a greater extent than traditional pedagogies, the CDC model shifts responsibility for the acquisition and application of content to students for the self-management and regulation of their learning experience.

The Construction-Deconstruction Connectionist Model (CDC)

The CDC model is based on a collaborative active learning in-class activity, which might also be named: "Name that Theory," "Name that Crime," "Name the Characteristic of Victorian Literature" etc. The model is built upon the premise that for purposes of classroom learning it is necessary to consider the four metacognitive domains that develop metacognitive expertise (Pang, 2008). These are: (a) the student (metacognition of self); (b) the classroom (metacognition of learning environment); (c) the professor (metacogni-

tion of professor); and (d) other students (metacognition of classmates) (Pang, 2008). In the CDC model, both the construction and deconstruction processes operate in a connectionist manner. Central to this model is the premise that learning must be chunked and connected. Chunking is a concept that is familiar in literature on the development of expertise and is used to explain the development of mental representations (Egan & Schwartz, 1979). For purposes of this model, learners chunk the main points or principles of a theory, the main elements of a statute, or, to be very specific, a characteristic of Victorian literature such as the depiction of women as "the Angel of the House," thereby facilitating learning through association, connections, and representations. This process of chunking and connecting content allows learners to apply the content with greater facility, speed, and ease in the deconstruction and connectionist steps in the model. In essence, it is an efficient way of organizing information for later retrieval, a form of parsing.

From an instructional strategy perspective, the learner must be encouraged to develop an understanding of the relevance of each lesson by connecting it to previously acquired learning and then demonstrate their ability to build upon that learning by the new construction and deconstruction of knowledge. Instruction must be designed so students acquire knowledge and develop understanding by continually upgrading previously established associations of content knowledge. The CDC model has four foundational steps.

The First Step: Construction

The first step is the process of construction of a definition or concept, which may or may not have been previously introduced in another context, by looking at a new problem or text that embodies that definition or concept. Students are asked to piece together a definition/statement of a concept by looking at the evidence in a new sample or form. In a literature classroom this might involve separating out and clarifying the parts of a text, detailing qualities of a particular character, or looking for actions that suggest a particular belief system. In a criminal justice class, students might be asked to discern a fact pattern or hypothetical theory from a scenario without guidance, input, or direction from the professor. The step of construction involves the learner in finding and assembling the details that adequately explain or illustrate a concept, theory, or principle. Often this is done in small, collaborative groups. In order to successfully engage in construction, a learner must come to an understanding of the components of the concept, theory, or principle at hand in sufficient detail so as to construct a contextual environment for later representation. This step is similar to a construction process advocated by Kintsch (1998), in research on comprehension, where he suggested that readers construct a text base that contains the propositional meaning of the text from the textual input. In accord with Kintsch, in our step of construction the learner activates relevant components from the new text and uses them to construct a coherent representation of a larger idea.

This step of construction also aligns with the precepts of schema theory that suggest there must be congruency between the interpretation or understanding of new knowledge and integration with activated schemata (Anderson, 1984). Sadoski, Paivio, and Goetz (1991) argued that "schemata are, by most accounts, abstractions derived from experience that

exist in a potential, nonspecific state, awaiting input," so these notions cannot exist "isolated from any of the examples that gave rise to it" (p. 467). Therefore, the construction step provides the means by which the learner transforms knowledge components that are disconnected or nonspecific from abstractions to tangible propositions that have meaning within the constructed illustrative environment.

The Second Step: Deconstruction

The second step requires deconstruction. Deconstruction, according to the researchers, is as the extraction and identification of the main or material components or concepts embedded in the definition, concept, or hypothetical the students previously constructed. The second step of deconstruction is analogous to reverse engineering (Ccolajanni, Concialdi, & Pellitteri, 2001) or component architecture in web-based environments (Stearns, Gargus, Schuetze, & Lombardi 2006). The purpose of this step is for students to demonstrate their understanding of the specific material components of the text, concept, theory, or case upon which they are working. For example, if a student work group has determined in the construction step that the character of Rochester in *Jane Eyre* shows evidence of being a Byronic hero, then in the deconstruction step, they must cite the specific details of his character, actions, or treatment by other characters that led to their construction of that theory.

The Third Step: Connection

According to Kintsch's (1998) work on comprehension, there is a mapping process between the knowledge and preexisting knowledge structures. This mapping is promoted in the third step of the model, which is connection. In the connection step, the learner is asked to take the details, facts, or examples deconstructed in the second step and specify their connections to their concept or theory. This connectionist step requires them to demonstrate the ability to perform illustrative connections. For example, a Victorian literature student might be asked why Rochester's treatment of the mad woman in his attic is heroic; or, more specifically, why this treatment makes him a Byronic hero rather than a more traditional kind of hero. A criminal justice student might be asked why a person's telephone records indicate his guilt or why certain finger prints at a crime scene would be inadmissible. By connecting illustrative exemplars of a theory to previously chunked components of that theory, students develop a type of coherence in their thinking from which they can draw inferences to illustrate depth of understanding in the fourth step.

The Fourth Step: Recreation

The purpose of the fourth step is to provide an opportunity for the learner and the professor to glean insights about the student's connection process and to ascertain the stability of the new learning in the recreation step, students are asked to invent an entirely new narrative, new character, or crime scenario that will demonstrating their new or more expert understanding of the cognitive content. Then, students present and explain their recreations. In providing commentary or explanatory text learners reveal their reasoning processes. Besides allowing students to engage creatively with the concepts they are

learning the fourth step of the CDC model provides further insights into a learner's understanding and application of the subject matter.

Research Purposes

The purpose of this research was four-fold: first, to design a novel learning model and activity that could be used in many academic disciplines; second, to test the model as an instrument for active learning by administering it in two classes from different content domains taught by two different professors; third, to assess the perceived learner value; and fourth, to determine any correlations between the perceived value of the learner activity and the learner's assessed understanding of the domain specific content.

Our research method integrated the previously-mentioned active learning theories in the four-step CDC model and tested them in a sophomore British literature survey class and an upper division criminal procedure class taught by two different professors. Students were provided on two separate occasions with a collaborative in-class activity calling upon their previous and on-going experience with course material. These activities required upon them to work together at tasks of identification, reasoning, critical thinking, and applied analysis. In the criminal procedure class, the in-class activity was conducted over two seventy-five minute sessions with a post-activity distributed as an extra credit assignment due the following class period. The in-class activity was designed to use the CDC model to have students build a case that contained issues of criminal law, criminal procedure, evidence, and Constitutional law while scaffolding the skills of identification, reasoning, critical thinking, and applied analysis. There was also a self-assessment of perceived value distributed in the last five minutes of the final class period. The in-class activity for the students in the British Literature course was designed to use the CDC model to have students build their understanding of literary representations of the hero collaboratively while scaffolding the skills of identification, reasoning, critical thinking, and applied analysis. The in-class activity was conducted over two seventy-five-minute sessions with self-assessment of perceived value distributed in the last five minutes of each class period.

Participants and Experimental Design[2]

Participants were undergraduate lower-level and upper-level division students at a University within the State of Texas University System, with a total enrollment of 6700 students. In the Criminal Procedure course, participants were twenty-eight upper division undergraduate students who were enrolled in a criminal justice curriculum. There were ten males (35.7%) and eighteen females (64.2%) who participated in the activity. Within the group, there were nineteen Caucasians (67.8%), six African-Americans (21.4%), one Mexican-American (3.5%), and one Asian-American (3.5%). The age range of the participants was from seventeen to thirty six-plus, with twenty one (75.0%) in the 17-25 age

[2] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_A.pdf for information on the materials for the Criminal Procedure and British Literature Courses and the referenced appendices.

group, four (14.2%) in the 26-35 age group, and three (10.7%) who were in the thirty six-plus age group.

In the British Literature course, participants were forty-four undergraduate students who were enrolled in the course as a part of the university's required core curriculum. Of the forty-four students, thirty-five were lower division (79.95%) and nine were upper division (20.45%). There were fifteen males (34.09 %) and twenty-nine females (65.9%) who participated in the activity. Within the group, there were forty Caucasians (90.9%), four African-Americans (9.09%), and one Hispanic-American (2.27%). The age range of the participants was from eighteen to thirty-six-plus with forty-three (97.72%) in the seventeen to twenty-five age group, two (4.5%) in the twenty-six to thirty-five age group, and one (2.27%) who was in the thirty-six-plus age group.

Group Formation for Criminal Procedure Students[3]

Procedure – Day One: Group Formation

Six student groups were formed by first asking students if they had a preference to work in the prosecution, defense, or judge groups and then by assignment by the instructor with each group designed to include a mixed academic background; some students had not studied criminal law while others had not studied evidence. Students were asked to disclose whether or not they had studied criminal law or evidence. These students were assigned to groups with other students who had completed these courses. Another factor related to group formation, considered by the instructor, pertained to seating during previous classes. Students sitting near the back of the classroom were instructed to join a group of students who typically sit near the front of the classroom.

The six groups were assigned the following roles: two groups would assume the role of prosecutor, two groups would work as the defense, and the remaining two groups assumed the role of judges. These roles were assigned according to individual preferences indicated by the students, the concern for a mixed and balanced academic background, where students usually sat in the classroom, and where the groups were located in the classroom. Two groups on the right were judges, two groups in the center were prosecutors, and two groups on the left were defense. Population of the groups ranged from four to five student members. Groups identified as J1 and J2 (Judges) had five members each. The group identified as P1 (prosecution) had five members, and the group identified as P2 (prosecution) had four members. The group identified as D1 (defense) had five members, and the D2 (defense) group had four members.

Procedure – Day Two: Instructions

Students were instructed to gather into the same groups as on Day One. A handout was distributed containing the summarized list of issues developed from the Day One activities as reviewed and slightly revised by the instructor. Each prosecutor group was in-

[3] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_B.pdf for information in instructions and reporting requirements for Day 1 for Criminal Procedure students.

structed to choose two issues from the list that would be used by the corresponding defense and judge group for the remainder of the in-class activities. Group P1 chose issue five (whether the defendant's confession was valid without a Miranda warning) and issue fifteen (whether a warrant was needed to search the home); group P2 chose issue nine (whether the defendant's 5th Amendment rights were violated during initial questioning) and issue thirteen (whether the methamphetamine and $10,000 could be excluded from trial).

Using the Factual scenario, all groups were instructed to deconstruct the factual scenario by identifying the relevant factual statements that pertained to the selected two issues by highlighting, circling, or underlining key words and noting their application to the issues, and then connecting each aspect of the issue with the supporting facts by annotating or formulating explanations to demonstrate an understanding of the connection. Fifteen minutes was allocated for this part of the Day Two activity. After the deconstruction and connection part of the activity was completed by the groups, the groups were provided with the following instructions:

1. P1 and P2 – using the information developed in the preceding activity, prepare a written argument for each issue that you will present to the judges so that they may render a determination based on your substantive argument.
2. D1 and D2 – using the information developed in the preceding activity, prepare a written defense argument that you will present to the judges so that they may render a determination based on your substantive argument.
3. J1 and J2 – write a model decision that demonstrates your reasoning for each issue; how and why you reached your decision, and the holding for each issue.

Thirty-five minutes was allocated for this part of the activity. In the final step of the activity, Defense and Prosecution groups submitted their written arguments to the corresponding Judge groups. The Judge groups were instructed to render a decision based on whether the Defense group or the Prosecution group presented the most persuasive and substantiated argument. Biases, opinions, and work done in previous activities were to be set-aside by the judge groups. Ten minutes was allocated for this element of the activity. When all groups were finished, a self-assessment of perceived value was distributed to each student who was instructed to complete it independently and individually. Approximately five minutes was allocated for the self-assessment. The instructor then collected the self-assessments and distributed a handout containing post activity questions (See Appendix C). These questions were related to the factual scenario, and required a greater degree of analysis than was presented in the in-class activity, primarily due to class time constraints (each class was a seventy five-minute class period) so students were instructed to complete the post-activity questions either individually or with self-selected classmates and submit it as extra credit at the start of the next class session.

Group Formation for British Literature Students[4]

Eight student groups were formed in the British Literature class according to similar student seating location; for example, the first two rows were divided into the first two groups. Population of the groups ranged from six to seven student members. The groups are indicated as follows: G1=group one, G2=group two, G3=group three, G4=group four, G5=group five, G6=group six, G7=group seven, and G8=group eight.

Use of textbooks, class notes, and other available course materials was approved, and the instructor encouraged conversation amongst members within each group. Students were allocated three periods of twenty five minutes to complete each of three of the CDC process steps in class. To assess the groups' time management skills, the instructor asked each group to estimate their completion percentage after twenty minutes of the allocated twenty-five-minute time-slots for each of the questions in the activity.

Results and Discussion: Criminal Procedure

During the Day One issue identification portion of the activity, J1 identified two issues; J2 identified seven issues; P1 and P2 identified two issues each, D1 and D2 identified four issues each. In terms of time management during the issue identification part of the activity, only one group (J1) completed the activity within the allotted time, while P1 and D1 were both over 90% complete; D2 and J2 were both 87% complete; and P2 was 75% complete. Additional time was provided so that all groups could finish the issue identification portion of the activity and the groups could work as a whole class in the issue selection process. During the collaborative consensus-oriented decision-making regarding commonalities and overlap of the issues, the class, with instructor facilitation and input, chose fifteen issues; six from J2, one from J1, two from P1, one from P2, two from D1, and three from D2. The majority of the issues came from J2 and D2.

During the Day Two deconstruction and connectionist activity of identifying material facts from the factual scenario and developing connections to applicable rules and procedures, only J1 finished in the allocated fifteen minute time period. P2 finished in eighteen minutes, D2 and D1 finished in nineteen minutes, and P1 finished in twenty two minutes. During the reasoning, critical thinking, and applied analysis portion of the activity, where the groups had to develop reasoning and analysis, the following observations were noted by the instructor and assistant:

1. J1 – three members were using texts, one was writing in spiral notebook. At twenty minutes, members were smiling and appeared to be relaxed. This group announced completion of the thirty five minute activity at twenty four minutes.
2. J2 – four members of the group were using the Holtz (2008) textbook. Typically, one member was talking while the rest were listening. This group finished the thirty five minute activity in twenty three minutes.

[4] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_C.pdf for Instructions and Reporting for British Literature students.

3. P1 – two members were reading from textbooks, two members were using their class notes. Work included intense conversation by all group members. This group finished the thirty five minute activity in twenty five minutes.
4. P2 – three members were reading from textbooks while the fourth member was using class notes. Intense conversation by all members was observed. This group appeared to be relaxed at twenty minutes and their conversation became more casual.
5. D1 – Two members were reading from textbooks while the other two were reading class notes. Conversation was minimal.
6. D2 – One member was reading from a textbook while another was reading class notes. The third member appeared to be detached from the group process.

In rendering the decision based on the arguments presented by P1 and D1 to J1 and P2 and D2 to J2; J1 found for the defense on the first issue determined that the confession was inadmissible.

On the second issue, J1 also found for the defense, holding that the forced entry without a warrant justified because of exigent circumstances. J2 also found for the defense on the first issue and determined that the Defendant was in custody without having received a Miranda warning so that the confession was inadmissible as evidence. On the second issue, J2 also found for the Defense and held that a warrant was required for the search of the bathroom and therefore the drugs and the money were inadmissible as evidence.[5]

The grading for issue identification was based not only on the identification of relevant issues, but also the depth and breadth of those issues as they pertained to the substantive cognate courses in the integrative frame model. Students who received a C (2.0) were able to identify relevant issues, but did not demonstrate breadth and depth in issue identification. Students who received a B (3.0) demonstrated relevance and breadth, but not depth in the issue identification. Students who received an A (4.0) demonstrated relevance, breadth, and depth in the issue identification. The issue identification had M = 2.67. The deconstruction of the factual scenario was graded based on the underlining, highlighting, or marking of the actual text and the relevance of the markings in the context of the assigned issues. This portion of the activity measured both identification and reasoning skills. The deconstruction of the factual scenario had M = 3.67. The connection of the deconstruction of the factual scenario to rules and procedures was graded based on markings of the actual text to show connections along with commentary and annotations that explained the connections between the material facts and the applicable rules and procedures in the context of the assigned issues. This portion of the activity measured identification, reasoning, and critical thinking skills. The connectionist portion of the activity had M = 3.33. The distribution of grades revealed that most students struggled with depth and breadth in the issue identification, but once issues were framed they were able to deconstruct the factual scenario and build a case. Two groups' weaknesses (M = 2.0) in the connectionist portion of the activity highlighted the need for further development

[5] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_D.pdf the scaffolding of metacognitive skill development presented in Table 1 and the instructor's grading of the activity components and the groups' success in demonstrating the activity skills as presented in Table 2.

of critical thinking skills. Most students were able to demonstrate reasoning skills (M = 3.67), critical thinking skills (M = 3.5), and applied analysis skills (M = 3.33), but struggled with issue identification and issue framing (M = 2.67). Only one group achieved M = 4.0 for all components of the activity.

For all of the questions M = 4.02 with SD = .10. Question 2 ("I think having an activity that teaches me how to identify important issues is") had the highest score with M = 4.31. This may reveal that students recognized their weaknesses in issue identification (M = 2.67), which was the lowest score of all of the components of the activities. Question 3 ("I think working in groups on in-class activities is") had the lowest score with M = 3.81, but was still between (3= helpful and 4 = very helpful). This seems to suggest that the effectiveness of activity-based work may be lessened for some students by being asked to do this work in groups, since question 1("I think the in-class activities are") had M = 4.12. Eight of the fifteen questions had M ≥ 4.0 (4= very helpful) and seven of the fifteen questions had M ≥ 3.8. The questions that had M ≥ 4.0 indicated that students found the in-class activities to be very helpful and they agreed that in-class activities also helped them to understand more about the course materials if they have a chance to use them in the activities. It also indicated that students valued activities that taught them how to (a) identify important issues (question 2 – identification, M = 4.31); (b) construct reasoning (question 5 – reasoning, M = 4.15); (c) analyze and critically think about the course material (question 15 – critical thinking, M = 4.19); (d) construct situations (question 6 – build a case, M = 4.0): and (e) use the course materials (question 13 – applied analysis, M = 4.0). In addition, one of the questions, which pertained to metacognition of the professor revealed that students preferred the instructor serving as a facilitator and walking around the classroom rather than standing in the front of the classroom and talking to the students (question 11, M = 4.23). One of the questions, which pertained to metacognition of classmates revealed that students found it very helpful to collaborate and discuss the material with their own groups and other groups within the class (question 9, M = 4.0).[6]

The post-activity was distributed to the students at the end of the last day of the in-class activity and students were instructed to complete it either individually or in a group. Students were informed that it was an extra credit activity. The students had four days to complete the post-activity. Of the twenty-eight students, eight submitted the extra credit post-activity. Six of the eight students completed the post-activity individually and two of the students completed it as a collaborative group. Of the eight students who submitted the post-activity, three of the students, were currently receiving an F in the course, one student was currently receiving a D, two students were currently receiving a C, and two students were currently receiving an A. These grades were based on the current completion of required assignments after the first month of the course. The two students who submitted the assignment as a group were currently receiving an F and a C respectively. The post-activity was graded as a regular assignment, pursuant to the general requirements for all course assignments for purposes of the activity; although for grading purposes it was counted as an extra credit assignment and the actual grade was not recorded by the instructor. This was not known to the students. The grades on the post-activity

[6] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_E.pdf for the descriptive statistics related to the self-assessment.

were distributed as follows: one A, one B, five Cs, and one F. The two students who were currently receiving the A in the course received the A and B respectively on the post-activity.

Results and Discussion: British Literature

During the issue identification portion of the activity, students were observed dividing and assigning roles and beginning to work as cohesive groups. In terms of time management during the issue identification part of the activity, four groups (G1, G3, G6, and G8) completed the activity within the allotted time, while G5 and G7 were both over 95% complete; G2, G4, and G7 were only 90% complete.[7] Additional time was provided so that all groups could finish the issue identification portion of the activity. During this initial step of the activity, the chief group members speaking were the scribes in all eight of the groups, and the rest of the group members were primarily silent and either looking inquisitive or moderately engaged.

The grading for issue identification was based on not only the identification of relevant issues, but also the depth and breadth of those issues as they pertained to the substantive content of the British Literature course.[8] Students who received a C (2.0) were able to identify relevant issues, but did not demonstrate breadth and depth in issue identification. Students who received a B (3.0) demonstrated relevance and breadth, but not depth in the issue identification. Students who received an A (4.0) demonstrated relevance, breadth, and depth in the issue identification. The issue identification had M = 3.33. This portion of the activity measured both identification and reasoning skills. The connection of the deconstruction of the course material to the elements identified in Step 1 was graded based the groups' narrative. The narrative must have explained the connections between the material facts and the applicable course content in the context of the assigned question. This portion of the activity measured identification, reasoning, and critical thinking skills. The connectionist portion of the activity had M = 3.16. The results are presented in Table 6.

Table 6.

British Literature Group Grades	**Session 1**	**Session 2**
Kind of Activity	**Grade average**	**Grade average**
Identification, analysis, "deconstruction" of concept	3.325	3.41
Development, creative construction	3.29	3.16
Connecting, applying concept	3.55	3.25

The self-assessment completed individually and independently by forty-four of the forty-nine students, measured student perception of the value of the in-class activity as well as

[7] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_F.pdf for the observations noted by the instructor and assistant.
[8] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_g.pdf for the instructor's grading of the activity components and the groups' success in demonstrating the activity skills are presented in Table 5.

its activity components and skills as perceived by the student to their learning and skill development. The fifteen questions were assessed on a 5-point Likert scale with 5, as extraordinarily helpful, 4 as very helpful, 3 as helpful, 2 as somewhat helpful, and 1 as not helpful.[9]

For all of the questions M = 3.540. Ten of the fifteen questions had M ≥ 3.5 (3= helpful) and five had M < 3.5. All of the questions had M ≥ 3.0. The questions that had M ≥ 3.5 indicated that being active in class, learning how to analyze, and constructing reasoning or explanatory scenarios were very helpful. Students also found interaction with classmates both in general and in specific ways (working together on thinking, discussion of findings) helpful to their learning. Question 8 ("I think having the chance to be active in class is") had the highest score for both sessions with M = 3.9885, strongly suggesting that students recognize the need for an interactive learning environment. This question also pertains to the metacognitive domain of self and indicates that the students find personal involvement or activity helpful to their learning. This is no surprise, but it reminds instructional designers of the importance of focusing upon students' personal experience. Question 15 ("I think learning how to analyze and critically think about the course material is") had the second highest combined score, with M = 3.9554. Question 5 ("I think constructing reasoning to understand the course material is") was third highest, with M= 3.7628. These results, taken together, indicate that students appreciate the need for analytical and critical thinking skills and possess a certain level of metacognitive awareness, even if their metacognitive abilities are weak.

Limitations and Opportunities for Further Research

Other results from the Likert scale data raise a number of issues that require further investigation. For example, the "opportunity to interact with classmates" (item 5) seems important to students, rating 5th in helpfulness overall (M = 3.751), but "in-class activities" were rated at the bottom (13th). Does this finding contest the validity of the data for question 8; suggesting students are willing to be passive? Similarly, students' responses to questions relating to the professor were ambiguous. Students rated as least helpful item 11, "I think the instructor walking around the room and working as a facilitator of my learning rather than standing up front and talking to me is…" Does this mean they prefer professors to be up front and talking to them, or simply that this professor was unhelpful? The next to the last item in terms of students' helpfulness ratings was 12, "I think in class activities help me learn more than listening to an instructor lecture raises several questions. Does it counter the central argument, and students' own reports, that active learning is more beneficial than passive learning? Does it register students' belief that they still need professors to lecture to them, to "teach" them first before they can become responsible for their own learning? Or, are these just statistically meaningless anomalies? [10]More research will be required to answer these questions.

[9] Please see http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_H.pdf for the descriptive statistics are presented in Table 7.
[10] See http://www.uncw.edu/cte/et/articles/Vol10_1/Pang_-_Hyperlink_I.pdf.

Another variable to consider in this research and for future research is how well the students performed on the active learning tasks assigned. In the literature class, for example, during the first round, students were given a theme or concept pertinent to the Romantic Period, a unit they had just completed. In the week prior to the activity, students had reviewed this material in class and at an optional after-class review session and had taken a midterm examination over it. In the CDC activity, then, they were asked to explain and illustrate a concept with which they had become very familiar. In the second round, students were asked to grapple with both old and new learning: Old knowledge from the Romantic period (the Byronic hero) and new knowledge from the Victorian period that they were just starting to study (they were asked to apply the concept of the Byronic hero to characters in the Victorian novel *Jane Eyre*). Students' best work was on the connecting of their concept to texts from the Romantic Period. On this assignment, their grades ranged from C to A, with an average of 3.55 (between a B+ and an A-). This performance probably reflects their recent preparation for their Romantic Period midterm, which included a lot of specific application of themes and concepts to texts. The second highest performance in the two rounds of activities, however, came with the second round analysis work. Students averaged 3.41 on their explanation of the various characteristics of the Byronic hero. This analysis was better than their original analysis exercise in Round 1 (average grade was 3.325). This suggests that several weeks after the midterm, their recall of the focus concept was still firm. Their ability to apply it, cold, to a new text was weaker (3.25); suggesting that while they seem to know the definition of the Byronic hero, they were not as confident in their application of the concept to a text without guidance from their instructor. In both cases, their grade averages on creative endeavors were between 3.16 and 3.29 at the B level. Not weak, but not as impressive as their other work. This makes sense, however, since the course is not one in which students are frequently asked to do creative writing. Instead, emphasis is upon their insight and recall of their reading and upon application of each new reading to what had been read the class before. These types of issues should be analyzed in future research.

Conclusion

Based on the findings from both courses, it appears that the majority of the students verified the following claims that learners benefit from opportunities to actively (rather than just passively) develop critical thinking and applied analysis skills and students find in-class activities very helpful in learning. It is too soon in our research to be able to state categorically that students using the CDC model improve their academic performance significantly; however, preliminary results suggest that the model could be useful if adapted to certain types of critical thinking tasks in classrooms across disciplines. If activities can be designed to attend to all four domains of metacognition: the self, the professor, classmates, and the environment (Pang, 2008); it is our belief that the CDC active learning model could help professors in most content areas. When professors expose students to strategies that promote deeper processing, active learning, and activity-based instructional strategies, those students are better equipped to succeed academically.

Many disciplines in the humanities, social, and physical sciences are interconnected and this interconnectedness provides educators with the opportunity to expand their instruc-

tional strategies to include cross-contextual applications. Our own individual research and this collaborative research project is an example of cross-contextual applications. Our continuing research and practice in teaching metacognition through engaging our students more actively argues strongly that other learners will understand and retain more information if their professors find better ways to show them that this information has relevance and meaning to them. Too often students are bombarded with new information that cannot be found in or related to their existing knowledge base. They find it exceedingly challenging, nearly impossible, to negotiate an understanding of such course material, much less store it for future use. Educators in all disciplines need to recognize the importance of developing a context for learning, and our model –with whatever adaptations teachers might make for their own circumstances--may aid in the implementation of an integrative approach to instruction. When students are able to make deeper-level connections to their course material the information becomes more important to them. Research supports the use of dynamic activities involving students' own epistemologies, the learning environment, and the classroom's community of scholars to negotiate the rocky terrain of critical thinking. Derived from a new vantage point, one that is more adapted to the individual student's needs, strengths, and experiences, this kind of learning is more substantial and long lasting.

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